Solution & Electrolyte

Lec. Haider Abdulkareem AlMashhadani

Lecture 2

Lecture Goals

- In this chapter you will learn how to:
- Describe the fundamental properties of a solution.
- Predict whether a substance is soluble in water or a nonpolar solvent.
- Electrolytes and nonelectrolytes.
- Calculate the concentration of a solution.
- Prepare a dilute solution from a more concentrated solution.
- Describe the process of osmosis and how it relates to biological membranes and dialysis.

1. Mixtures

- A Mixture composed of two or more pure substances. The air we breathe is composed of nitrogen and oxygen, together with small amounts of argon, water vapor, carbon dioxide, and other gases.
- Seawater is composed largely of sodium chloride and water.
- A mixture may be heterogeneous or homogeneous.
  - ***A heterogeneous mixture*** does not have a uniform composition throughout a sample.
  - ***A homogeneous mixture*** has a uniform composition throughout a sample.

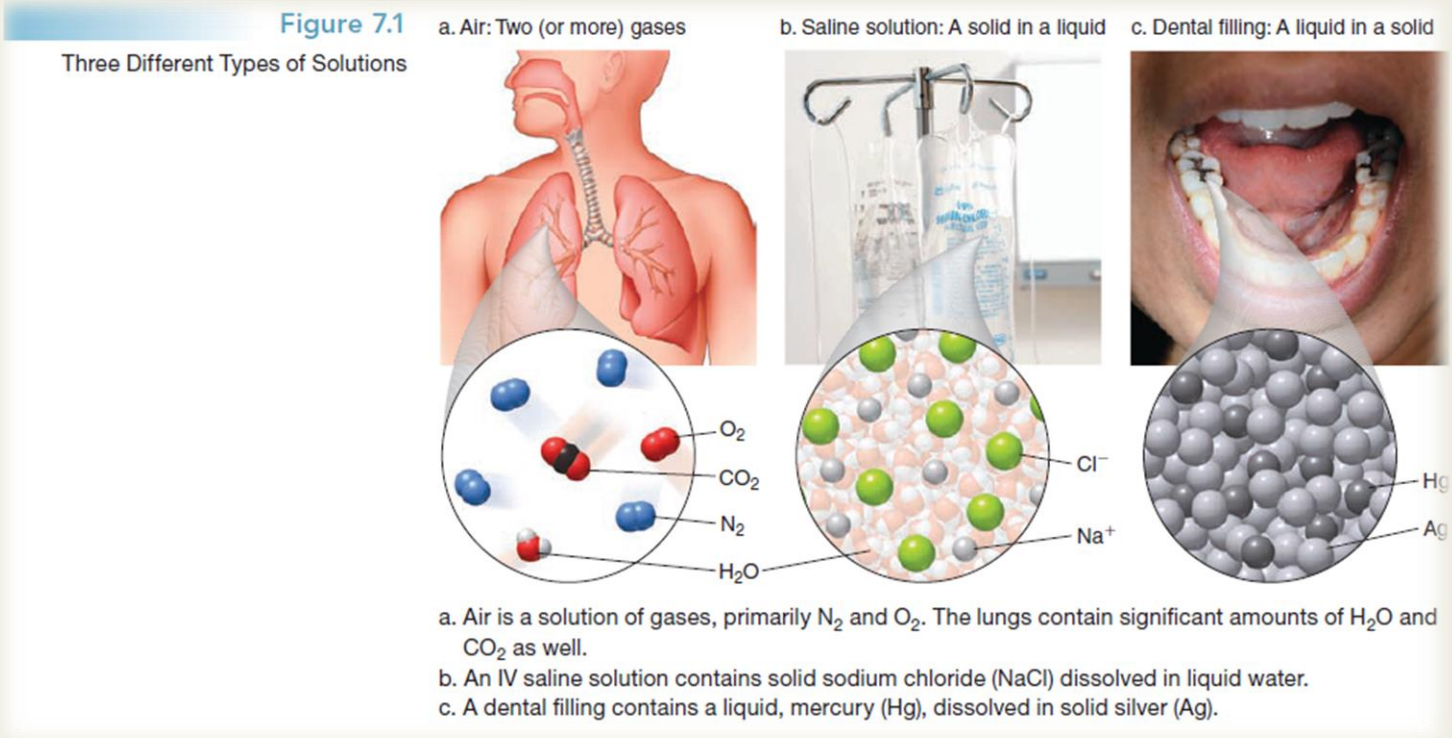
A pepperoni pizza is a heterogeneous mixture, while a soft drink is a homogeneous solution.

Amalgam filling is a silver dissolve in Hg as homogenous mixture.

2. Types of Mixture

A. solution is a homogeneous mixture that contains small particles. Liquid solutions are transparent.

When two substances form a solution, the substance present in the lesser amount is called **the solute**, and the substance present in the larger amount is the **solvent**. A solution with water as the solvent is called an aqueous solution.



Types of Mixture

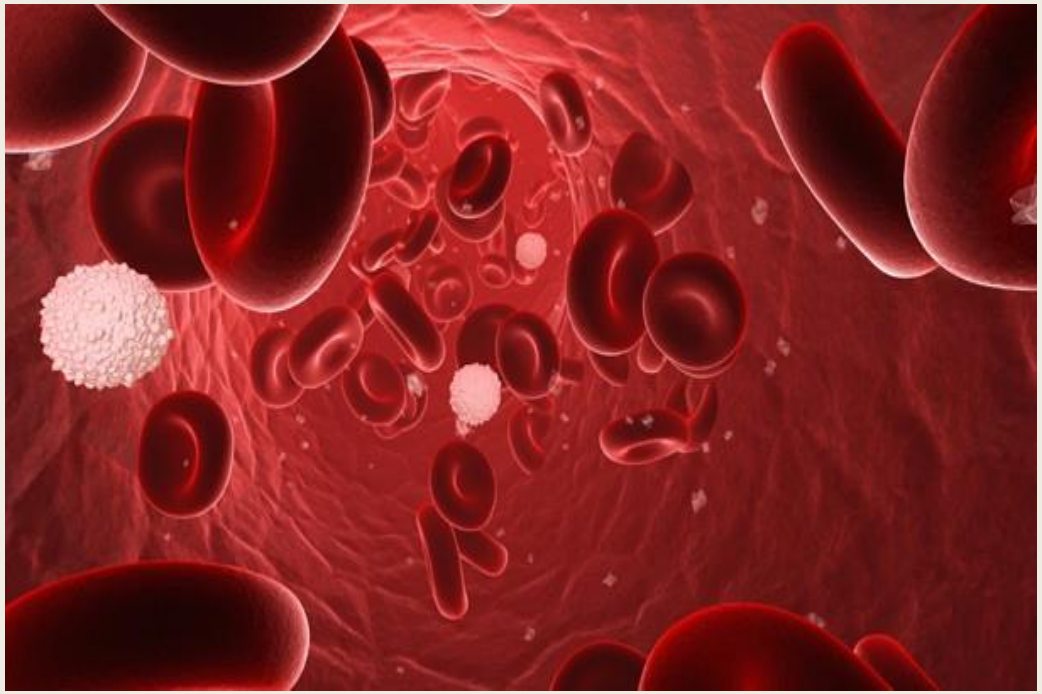
B. Colloid is a homogeneous mixture with larger particles, often having an opaque appearance.

- The particles in a colloid generally cannot be filtered from its order components, and they do not settle out on standing.
- By addition, **a colloid contains particles that are 1nm-1µm in diameter**. Milk is a colloid. Homogeneous milk is an opaque homogeneous mixture contains large protein and fat molecules that do not dissolve in water.

C. Suspension is a heterogeneous mixture that contains large particles suspended in a liquid.

- **A suspension contains particles greater than 1µm in diameter.**
- The particles are so large that they do not dissolve in a liquid, and they can filtered away from the liquid, or separated using a centrifuge.

Health Note



Blood is a suspension containing blood cells that can be separated from liquid blood plasma by centrifugation.

Zinc oxide eugenol (ZOE) is a material created by the combination of zinc oxide and eugenol contained in oil of cloves. Mixed at a powder-to-liquid ratio of 1:3 to achieve a homogeneous mix. (colloid type)

This table summarizes the properties of solutions, colloids, and suspensions.

Properties of Solutions, Colloids, and Suspensions			
	System		
Property	**Solution**	**Colloid**	**Suspension**
Particle type	Ions, atoms, small molecules	Large molecules or particles	Large particles or aggregates
Particle size	0.1–1 nm	1–1000 nm	1000 nm and larger
Effect of light	No scattering	Exhibits Tyndall effect	Exhibits Tyndall effect
Effect of gravity	Stable, does not separate	Stable, does not separate	Unstable, sediment forms
Filtration	Particles not retained on filter	Particles not retained on filter	Particles retained on filter
Uniformity	Homogeneous	Homogeneous	Heterogeneous

PROBLEM

Classify each substance as a heterogeneous mixture, solution, or colloid:

(a) Cherry Garcia ice cream (cherry ice cream + chocolate bits + cherries);

(b) mayonnaise;

(c) seltzer water;

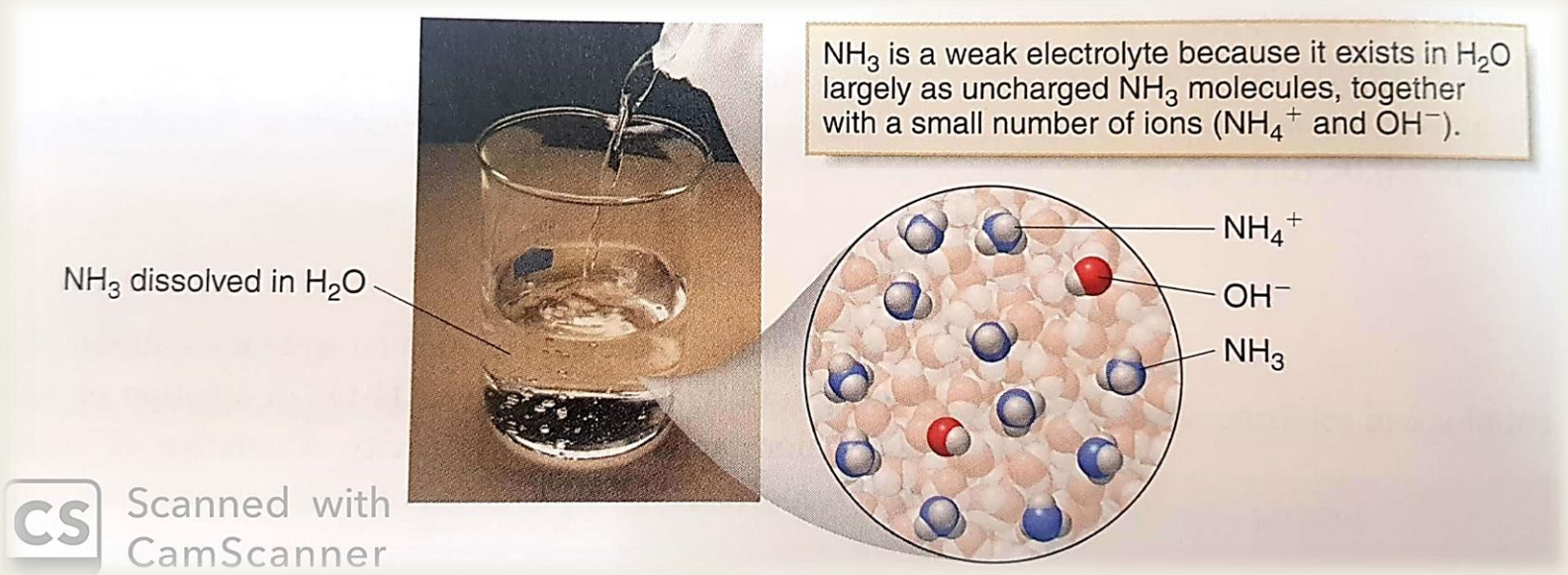
(d) nail polish remover;

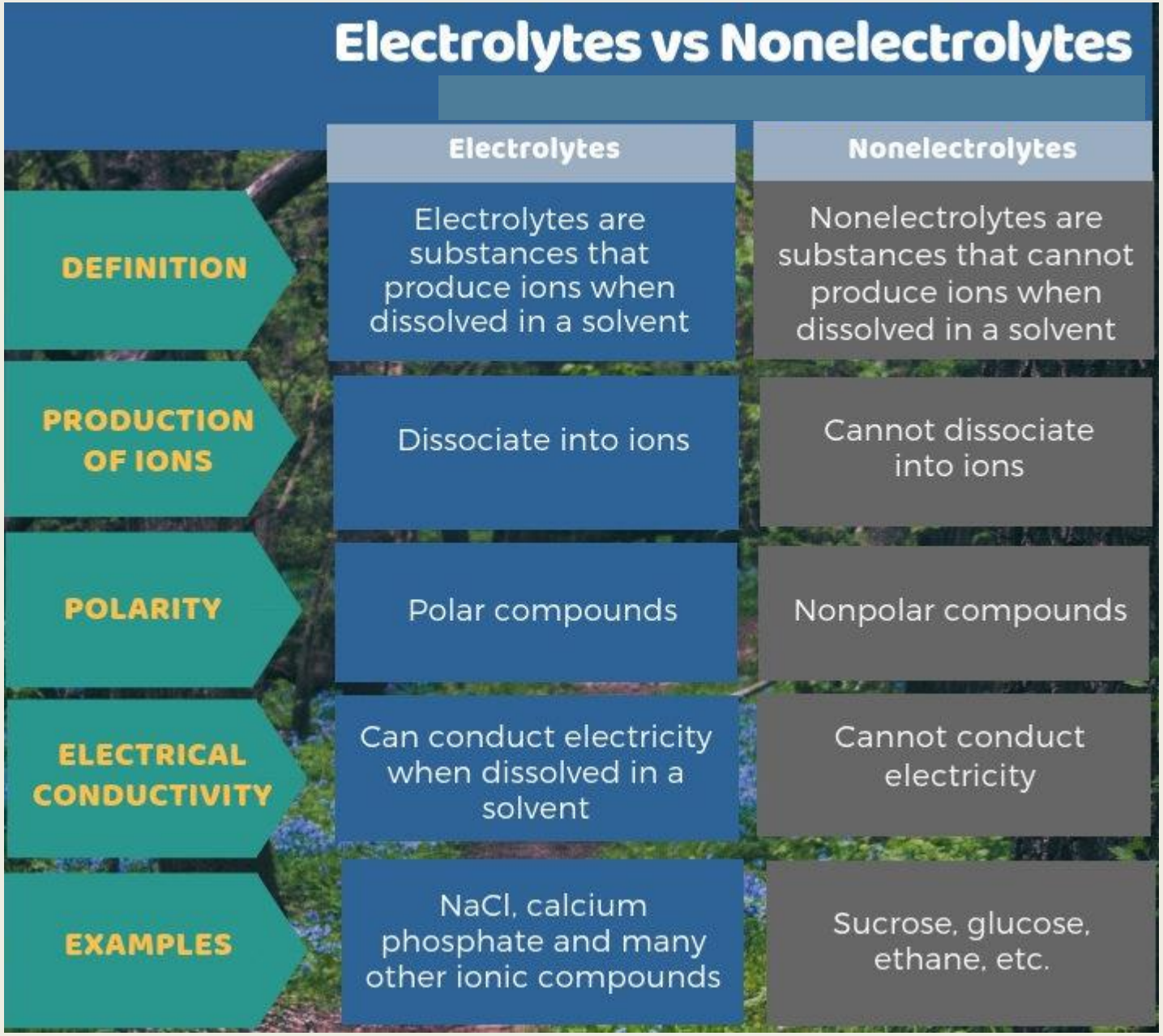
3. Electrolytes and Nonelectrolytes

- A solute that dissolve in water to from ions conducts electricity, whereas a solute that contains only neutral molecules does not.
- A substance that conducts an electric current in water is called ***an electrolyte***. NaCl is an electrolyte.
- A substance that does not conduct an electric current in water is called ***a nonelectrolyte.*** H_2O_2 is a nonelectrolyte.
- Thus, an aqueous solution of sodium chloride, NaCl, contains Na^+ cations and Cl^- anions and conducts electricity. An aqueous solution of hydrogen peroxide, H_2O_2, contains only neutral H_2O_2 molecules in H_2O, so it does not conduct electricity.

Classification of Electrolytes

- Electrolytes can be classified as strong or weak, on the extent that the compound dissociates (forms ions).
- A strong electrolyte dissociates completely to form ions when it dissolves in water. Like NaCl.
- A weak electrolyte dissolves in water to yield largely uncharged molecules, but small fraction of the molecules form ions. Like ammonia NH_3

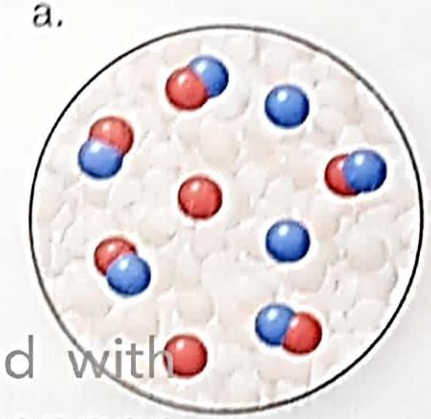



Electrolytes vs Nonelectrolytes
Electrolytes
Nonelectrolytes
DEFINITION
Electrolytes are substances that produce ions when dissolved in a solvent
Nonelectrolytes are substances that cannot produce ions when dissolved in a solvent
PRODUCTION OF IONS
Dissociate into ions
Cannot dissociate into ions
POLARITY
Polar compounds
Nonpolar compounds
ELECTRICAL CONDUCTIVITY
Can conduct electricity when dissolved in a solvent
Cannot conduct electricity
EXAMPLES
NaCl, calcium phosphate and many other ionic compounds
Sucrose, glucose, ethane, etc.

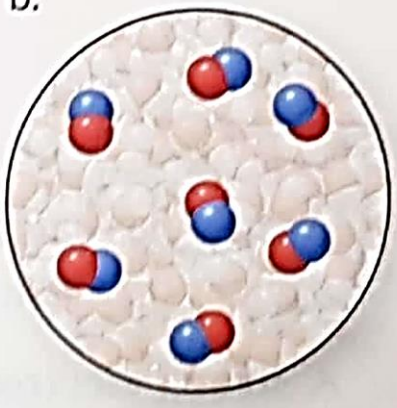
PROBLEM 7.3

Consider the following diagrams for an aqueous solution of a compound **AB** (with **A** represented by red spheres and **B** represented by blue spheres). Label each diagram as a strong electrolyte, weak electrolyte, or nonelectrolyte.

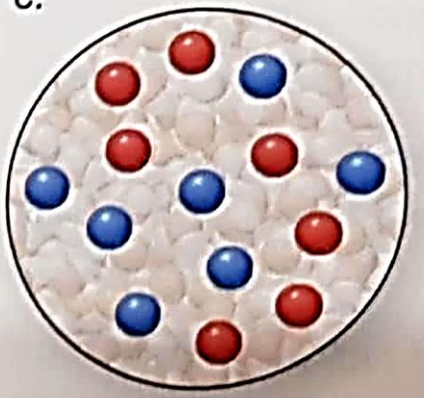
a.



b.



c.



End